Title: *Scaling of Planetary Magnetosphere Boundaries and Processes*

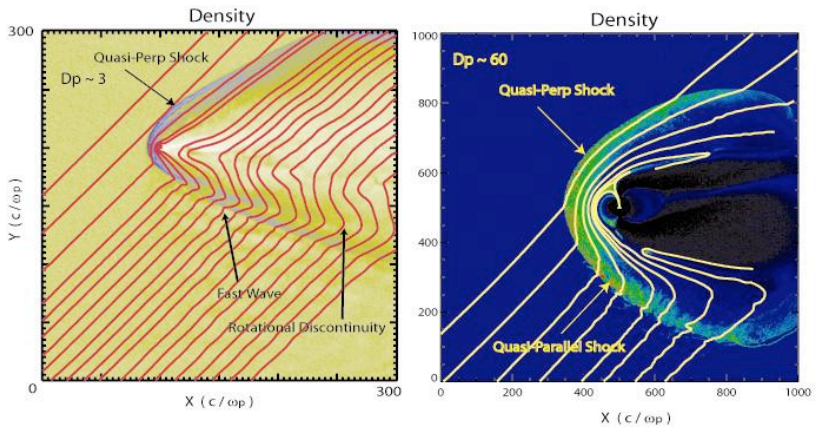
Cluster: *Cross-Theme Theory and Data Analysis/SECTP*

Contributor: *H. Karimabadi/University of California San Diego*

- **Similarities and Differences between Earthlike Magnetospheres**

Earlier, the UCSD SEC Theory Program funded group showed that the interaction of the solar wind with planetary dipole magnetic fields of various strength produce a spectrum of magnetospheric structures with spatial extents and complexities that increase with magnetization. This is quantified by the parameter $D_p$, the radial distance from the dipole to the point at which the solar wind ram pressure and magnetic pressure are balanced (normalized to solar wind skin depth). Recent new global hybrid model simulations by this group show that although the global structure of dipolar magnetospheres becomes Earthlike for $D_p$ at ~ 20 (e.g., planet Mercury conditions), this does not imply that all processes kick in at the same scale. For example, the quasi-perpendicular portion of the planetary bow shock is formed at $D_p$ ~ 3 which is before the magnetosphere structure becomes terrestrial-like, but the quasi-parallel part of the shock does not become evident until values greater than 30. Hence, while it is true that the global characteristics of dipolar magnetospheres become earthlike for D>20 we are not guaranteed that all the magnetospheres have the same characteristics as at Earth.

The model efforts by the UCSD group for the first time address the requirement to capture details of small-scale physics while accounting for global interactions. This will apply to planned multiscale missions, such as MMS (Magnetosphere Multiscale Mission). The simulations enable new types of questions to be addressed regarding the inner workings of magnetosphere and provide new use for data from past and future NASA missions both at Earth and other solar system bodies.




*Scaling of bow shock from two global simulations for Earthlike magnetospheres of different scales.*

*Plasma densities are color shadings on top of magnetic field line topologies- gray depicting maximum density on the left and green-yellow on the right.*

*Distinct parallel shock structure develops on the right, but not for the lower $D_p$ value on the left, while the quasi-perpendicular structures are similar.*

Reference: Omidi, N., X. Blanco-Cano, H. Karimabadi, C. Russell, "Macrostructure of the bow shock and ion foreshock: Scale lengths, J. Geophys. Res., in preparation, 2004b.